

A new genus of small coral-reef goby (Teleostei: Gobiidae) from the Indo-west Pacific, with discussion of its relationships

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ABSTRACT

A new genus and species, *Minysicya caudimaculata*, is created for a small coral reef gobiine known so far from the Yaeyama Islands, Ryukyu Archipelago, Japan; Scott Reef off northern Western Australia; Lizard Island, Queensland; and the Tuamotu Islands, French Polynesia. Phylogenetic analysis shows that *Minysicya* n. gen. forms a monophyletic group with five other genera including *Bryaninops* and *Pleurosicya* (commensal on various invertebrates and plants), but has fewer of the specialisations exhibited by the other genera.

KEYWORDS: Indo-Pacific, Gobiidae, Gobiinae, *Minysicya caudimaculata* new genus new species, *Bryaninops*, *Pleurosicya*, commensal.

INTRODUCTION

In 1984, Barry Russell of the Museum and Art Gallery of the Northern Territory, Darwin, collected five gobiid fish specimens that resembled the commensal goby genus *Bryaninops* Smith, from Scott Reef, off north-western Australia. From their characters of separate interorbital canals on the head, a very reduced fold anteriorly on the frænum, reduction or absence of pelvic fin lobes, very fine teeth with no canines present, and lower pectoral rays unbranched (but unthickened), the specimens appeared to be an unspecialised form of *Bryaninops*, with body morphology resembling *Bryaninops natans* Larson, 1985. However, the new specimens had no posterior oculoscapular canal over the preoperculum, unlike *Bryaninops*. During a visit to Okinawa in 1985, I found a single specimen (from Iriomote-jima) in the University of the Ryukyus' fish collection. Dr T. Yoshino kindly allowed me to borrow the specimen to compare with the Western Australian material. Additional specimens from Lizard Island, Queensland, Ishigaki-jima, Japan, and the Tuamotus, French Polynesia, were eventually recognised as belonging to this species.

One specimen was cleared and counter-stained, for osteological comparison with other gobiines. It was found to belong to the large coral reef Priolepis Group, a phenetic grouping which includes the majority of Indo-Pacific coral reef gobiines (Birdsong *et al.* 1988), including the "seawhip-gobies" (*Bryaninops*) and other coral and octocoral commensals (e.g. *Pleurosicya* and *Lobulogobius*). The genus and its only known species are here described as new.

METHODS AND MATERIAL

Counts and measurements follow the methods used by Larson (1985). Specimens are deposited in the Australian Museum, Sydney (AMS); Biological Laboratory, The Imperial Household, Tokyo (BLIH); Museum and Art Gallery of the Northern Territory, Darwin (NTM); and the University of the Ryukyus, Naha (URM).

I suspected that the small commensal gobies probably form a monophyletic group within the diverse Priolepis Group of Birdsong *et al.* (1988) (and see Larson 1990), so the new genus was compared with *Bryaninops*, *Pleurosicya*, *Phyllogobius*, *Luposicya* and *Lobulogobius*. These five genera are all commensal on corals, gorgonians and other invertebrates and exhibit several specialisations (Larson 1990). For the phylogenetic analyses, characters were polarised against other gobiines as indicated below. *Acentrogobius* (*caninus* species-group), *Bathygobius* and *Glossogobius* were used as outgroups, and all possess the character states assigned to the composite outgroup in the matrix in Table 2. These genera are generally accepted as being less specialized than many of the other gobiines which include the "coral reef" commensal goby genera (Gill *et al.* 1992; Birdsong *et al.* 1988). Analyses were made using PAUP* 4 beta10 (Swofford 2002), with characters unordered and unweighted.

Cleared and stained comparative material examined included: *Bryaninops amplus* (one paratype, NTM S.11082-001; one specimen, NTM S.13026-001), *B. isis* (one specimen, NTM S.13030-001), *B. yongei* (one specimen, NTM S.13028-001; one specimen, NTM

S.13029-001; one specimen, NTM S.13025-001), *Lobulogobius omanensis* (one specimen, NTM unregistered), *Luposicya lupus* (one specimen, NTM S.12717-001), *Phyllogobius platycephalops* (one specimen, NTM S.13027-001), *Pleurosicya amandalei* (three specimens, NTM unregistered), *P. coerulea* (one specimen, NTM S.13032-001), *P. fringilla* (one specimen, NTM S.13031-001), *P. mossambica* (one specimen, NTM S.12642-001), and *P. prognatha* (one specimen, NTM S.21316-001).

SYSTEMATICS

Family Gobiidae Subfamily Gobiinae *Minysicya* new genus

Type species. *Minysicya caudimaculata* new species, by original designation.

Diagnosis. Small, slender goby with first dorsal VI; second dorsal and anal rays I,8; pectoral rays all unbranched, usually with 14 rays, none thickened; longitudinal scales 22-24; TRB 6-7; scales on body ctenoid, extending forward to just above pectoral base, not extending onto head; pelvic fins small, fused, forming narrow cup, with very narrow anteriorly-facing fold on fraenum often present, pelvic spines with no or almost no fleshy lobe development; sensory papillae on head reduced; oculoscapular canals on head separate, with two anterior and two posterior interorbital pores, no posterior oculoscapular canal, no nasal pores, three preopercular pores; no canine teeth present; upper jaw protrusible, opening downward; body translucent with six red internal bars and small black spots at base of caudal fin; known from coral reefs and associated algal and seagrass beds.

Osteology. Based on two specimens, 8.5-13 mm SL. Branchiostegal rays 5; no dorsal post-cleithrum; no mesopterygoid; metapterygoid reduced, does not reach quadrate; short process reaches from preoperculum toward posteroventral portion of symplectic (the two bones are close due to enlarged orbit); pterygoid broad, especially ventrally; palatine very slender, extending about half the length of pterygoid; premaxilla straight, with tall ascending process (equal in height to length of premaxilla), distinct triangular articular process present; maxilla narrow but stout, posterior tip rounded; dentary short and stout, curving steeply upward at about mid-point of bone, teeth present along whole length of dentary; articular long, broadening posteriorly; frontals broadest posteriorly, anteriorly form upswept ridge over orbit dorsally; supraoccipital without median crest, narrow anteromedian projection present part-way over frontals; sphenotic narrow, just touching lateral wing of supraoccipital; basihyal long, narrow, broadening toward tip; scapula entirely cartilaginous; anteroventrally-

directed short slender ventral processes of pelvic bones diverging at tips and forming narrow Y; pelvic fin spines straight; vertebrae 10+16, including urostyle; haemal arches of first few caudal vertebrae expanded, amount of expansion decreasing posteriorly; short pleural rib present on first caudal vertebra only; last abdominal vertebra with long pleural ribs, which nearly meet ventrally; caudal skeleton with hypurals 1-2 fused to urostyle (in larger specimen); single epural; neural spine on last vertebra very low and rhomboid; hypural 5 rod-like; parhypural free, with low ventral flange.

Etymology. From the Greek *minys* (small), referring to the very small adult size of this species (largest specimen a 15 mm SL mature female) and *sikya* (an old Greek word for a cupping-glass), referring to the distinctive, cup-shaped pelvic fins of this fish's closest relatives, and echoing the names of two of these, *Pleurosicya* and *Luposicya*. Gender is feminine.

Minysicya caudimaculata new species

(Figs 1-6; Table 1)

Type Material. HOLOTYPE - NTM S. 11383-027, 13 mm SL male, North Reef, Scott Reef, Western Australia, 20 m depth, coll. B.C. Russell, 11 September 1984. PARATYPES - out of NTM S. 11383-033, 3(13-13.5), one cleared and double-stained, same data as holotype; NTM S.11373-049, 1(13), Scott Reef, 20-25 m depth, coll. B.C. Russell, 8 September 1984; AMS I.25121-009, 8(7-12), 2.8 km E of Crystal Beach, Lizard Island, 36-38 m depth, epibenthic plankton sled, coll. J.M. Leis, 31 January 1982; URM P.4686, 1(14), Amitori Bay, Iriomote-jima, Ryukyu Islands, coll. T. Yoshino and K. Shimada, 9 September 1982; BLIH 1992269, 5(13.3-15), *Zostera* seagrass bed, Kabira Bay, Ishigaki, Ishigaki-jima, Okinawa, 3-4 m depth, coll. S. Hosoya, A. Iwata, Y. Ikeda, 25 November 1992; BLIH 1992241, 10(14-14.9), same data as preceding; AMS I.34514-011, 4(8-10.5), 600 m NE of house, Taiaro Atoll lagoon, Tuamotu Islands, French Polynesia, 15-18 m depth, rotenone, coll. P. Doherty, J. Leis and T. Trnski, 17 February 1994; AMS I.34514-014, 1(8.5), cleared and double-stained, 600 m NE of house, Taiaro Atoll lagoon, Tuamotu Islands, French Polynesia, 15-18 m depth, rotenone, coll. P. Doherty, J. Leis and T.



Fig. 1. Holotype of *Minysicya caudimaculata* n. gen. n. sp., NTM S. 11383-027, 13 mm SL male, Scott Reef, Western Australia. Photograph by Rex Williams.

Table 1. Meristics and measurements (in mm) of *Minysicya caudimaculata* n. gen. n. sp.

| | Mean | Max. | Min. | Mode |
|------------------|------|------|------|------|
| First dorsal | 6.0 | 6.0 | 5.0 | 6.0 |
| Second dorsal | 7.8 | 8.0 | 7.0 | 8.0 |
| Anal | 8.0 | 9.0 | 7.0 | 8.0 |
| Pectoral | 13.7 | 15.0 | 12.0 | 14.0 |
| Lateral scales | 23.0 | 24.0 | 21.0 | 23.0 |
| TRB | 6.2 | 7.0 | 5.0 | 6.0 |
| SL | 12.6 | 15.0 | 9.0 | 14.0 |
| Head length | 3.8 | 4.5 | 2.9 | 4.1 |
| Head depth | 2.1 | 2.5 | 1.7 | 2.0 |
| Head width | 1.8 | 2.0 | 1.5 | 1.9 |
| Body depth | 2.4 | 3.0 | 1.8 | 2.2 |
| Caud. ped. leng. | 3.4 | 4.3 | 2.4 | 3.3 |
| Caud. ped. depth | 1.2 | 1.5 | 0.9 | 1.4 |
| Snout length | 1.0 | 1.3 | 0.6 | 1.0 |
| Eye width | 1.3 | 1.5 | 1.0 | 1.4 |
| Jaw length | 1.2 | 1.5 | 0.8 | 1.3 |
| Interorbital | 0.6 | 0.8 | 0.5 | 0.6 |
| Pectoral length | 2.6 | 3.0 | 2.1 | 2.5 |
| Pelvic length | 1.9 | 2.3 | 1.5 | 2.0 |
| Caudal length | 3.0 | 3.3 | 2.4 | 3.3 |

Trnski, 17 February 1994; AMS I.34515-007, 5(9-12), 600 m E of house, Taiaro Atoll lagoon, Tuamotu Islands, French Polynesia, 24 m depth, rotenone, coll. P. Doherty, J. Leis and T. Trnski, 18 February 1994; AMS I.34866-003, 1(9.5), southern corner of lagoon, Taiaro Atoll, Tuamotu Islands, French Polynesia, 4-8 m depth, rotenone, coll. P. Doherty, J. Leis and T. Trnski, 17 February 1994.

Additional material. AMS I.34510-036, 1(8), off collapsed wharf, Tairo Atoll, Tuamotu Islands, French Polynesia, 0-2 m, coll. Tairo party, 14 February 1994 [not in good condition].

Description. Based on 32 specimens, 8.5-15 mm SL. An asterisk indicates counts of the holotype (Fig. 1). Osteological information from two cleared and stained specimens.

First dorsal VI* (V in one); second dorsal 1,7-8*, modally 1,8; anal 1,7-8*, modally 1,8, pectoral rays 12-15 (modally 14, 13 in holotype), segmented caudal rays 17*; caudal ray pattern 9/8; branched caudal rays 6/5; unsegmented (procurrent) caudal rays 4/3; longitudinal scale count 21-24 (mean 23*); TRB 5-7, usually 6* (Table 1). Pterygiophore formula 3-22110. Vertebrae 10+16. Pectoral fin rays all unbranched. Neural spines of first few vertebrae slender and pointed. One epural. Two anal pterygiophores before haemal spine of first caudal vertebra. First four caudal vertebrae with widely expanded haemal arches; first caudal vertebra with pleural ribs.

Head and body slender, compressed, head length 3.1-3.5 (mean 3.3) in SL. Head depth at posterior preopercular margin 1.7-2.0 (mean 1.8) in HL. Head narrow, width at posterior preopercular margin 1.9-2.5

(mean 2.2) in HL. Mouth short, terminal, lower jaw tip usually anteriormost; jaws just reaching to below anterior margin of eye. Lips thin, smooth. Upper jaw 2.7-3.6 (mean 3.1) in HL; fully extended jaws protruding forward and downward. Eye large, lateral, top forming part of dorsal profile, 2.6-3.2 (mean 2.9) in HL. Snout pointed, often with convexity before eye due to long ascending process of premaxilla, 3.3-4.9 (mean 4.1) in HL. Interorbital relatively flat, moderate in width, 4.9-8.8 (mean 6.1) in HL. Body depth at anal origin 4.5-6.3 (mean 5.3) in SL. Caudal peduncle long, slender, length 3.3-4.8 (mean 3.8) in SL. Caudal peduncle depth 9.3-12.5 in SL (mean 10.7).

No mental fracnum, lower lip free at sides, narrowly joined to chin anteriorly. Anterior nostril in slender thin tube placed just closer to upper lip than to eye; posterior nostril oval, without raised rim, placed close to anterodorsal edge of eye. Gill opening extending forward to under mid-opercle. Lower quarter (at most) of first gill arch bound to opercle by membrane. Gill rakers on outer face of first arch reduced to few short stubby rakers by angle of arch, rudiments present on lower limb; rakers on inner face of arches short and stubby, rakers on outer face of other arches short, stubby, with few tiny spines at tip. Tongue thin, tip usually blunt, slightly concave or slightly irregular.

Outer row teeth in upper jaw small, curved, sharp and evenly sized (no canines); one or two rows of very tiny short pointed teeth behind outer row across front of jaw only. Lower jaw with four to five rows of curved, sharp, evenly sized teeth across front, only one row of teeth along side of jaw, with largest teeth posteriormost. Lower jaw sexually dimorphic. In males, posterior portion of dentary steeply curved dorsally, so that rear teeth on dentary point almost anteriorly (Fig. 2). In females, posterior portion of dentary less curved dorsally and teeth along side of jaw smaller than in males or absent from curved portion of dentary altogether.

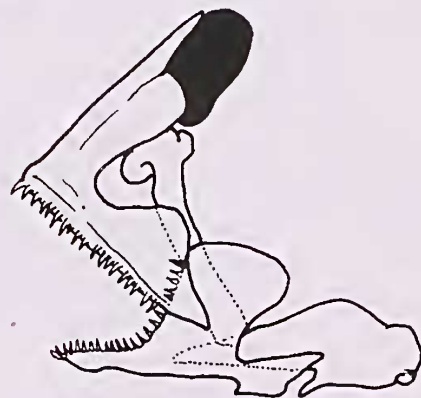


Fig. 2. Jaws of *Minysicya caudimaculata* n. gen. n. sp., showing curved dentary and small anteriorly-oriented teeth, ex NTM S.11383-027, 14 mm SL male. Cartilage shown in black.

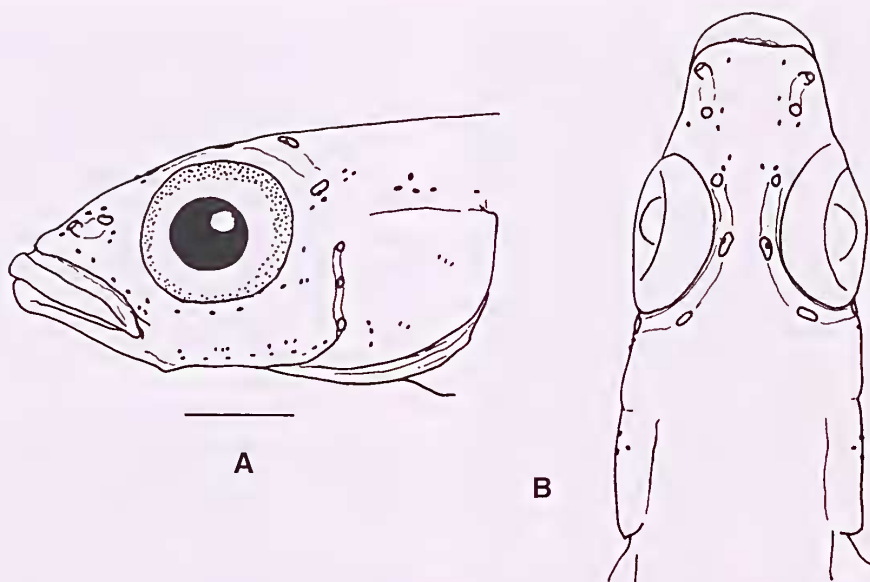


Fig. 3. *Minysicya caudimaculata* n. gen. n. sp., BLIH 1992269, 14.5 mm SL paratype female. A, lateral view of head, showing sensory papillae; B, dorsal view of head, showing oculoscapular canals and pores. Scale bar = 1 mm.

Head, nape, pectoral base, breast and belly naked. Ctenoid scales on side of body extend forward to just above pectoral base.

Head pore pattern reduced (Fig. 3). No nasal pores; paired anterior and posterior interorbital pores in separate interorbital canals, postorbital pore behind eye, infraorbital pore below postorbital, no posterior oculoscapular canal or pores; three preopercular pores present (rarely, preopercular canal open).

Sensory papillae pattern on head in reduced longitudinal pattern, as in Figure 3.

First dorsal fin approximately triangular, rounded to slightly pointed in outline, origin directly over pelvic fin origin. First dorsal fin spine slightly shorter than next two; fin not reaching first element of second dorsal fin when depressed. Second dorsal fin short, anterior rays longest, more than twice height of posteriormost ray, giving fin a triangular appearance. Anal fin similar in shape, but third or fourth rays longest. Pectoral fin pointed, central rays longest, all rays unbranched, tips of rays not thickened, 4.2–5.8 (mean 4.9) in SL. Pelvic fins (Fig. 4) fused, forming oval cup, reaching to anus, 5.8–8.8 (mean 6.9) in SL; first to fourth rays branched 2–5 times at tips, which are free of membrane, fifth ray narrower than others and unbranched or only branched once; skin around tips of pelvic spines thickened in some specimens, tips of rays usually slightly thickened; edge of fraenum slightly thickened and rolled forward in most specimens. Caudal fin slightly rounded to truncate, 3.6–5.0 (mean 4.3) in SL.

Male genital papilla elongate, slender, flattened distally, narrowing toward tip, which is expanded and fimbriate. Female genital papilla short, bulbous, with

two finger-like lobes on either side of opening (resembling cow's udder).

Coloration of preserved material. Head and body pale whitish to pale brown (depending upon preservation), with most conspicuous markings being three dark brown spots around the caudal fin base (Fig. 5). Head unpigmented but for variable dusting of melanophores behind eye (some pigment internal, over brain, visible through body tissues), few melanophores below anterior nostril or on upper lip. Iris encircled with dark brown.



Fig. 4. Pelvic fins of *Minysicya caudimaculata* n. gen. n. sp., showing reduced fold on frenum, BLIH 1992241, 14 mm SL male. Scale bar = 0.5 mm.



Fig. 5. *Minysicya caudimaculata* n. gen. n. sp., recently dead specimen (URM P.4686) from Amitori Bay, Iriomote-jima, Japan. From colour slide by T. Yoshino. Fin outlines reconstructed.



Fig. 6. Living *Minysicya caudimaculata* n. gen. n. sp. over seagrass bed, 3 m in depth, at Kabira Bay, Ishigaki-jima, Okinawa. Photograph by Seiichi Hosoya.

Peritoneum evenly speckled with brown dorsally and laterally, usually unpigmented ventrally, pigment showing through body wall. Breast with one to several melanophores, some internal and directly dorsal to melanophores on skin; pigment may form narrow streak along mid-ventral line of breast and isthmus. Anus and genital papilla usually unpigmented. Fine brown speckling present along mid-ventral line of body, extending dorsally about a quarter-way up side of body, speckling usually forming indistinct streak running from anal fin origin to just before lowermost dark spot on caudal base; speckling may be diffuse or reduced to thin mid-ventral brown line only.

On middle of caudal fin base, a small, approximately triangular to diamond-shaped dense dark brown spot present, spot may extend out onto caudal rays; similar spots across dorsal and ventral precurrent rays. In some specimens, small dark specklings join all three spots together along hypural crease. Area on caudal peduncle immediately anterior to three dark spots almost always unpigmented.

First dorsal fin translucent, with tip or distal third of fin with diffuse blackish spot or dusky band, some specimens with few distinct melanophores on anterior fin membranes close to fin base. Second dorsal fin translucent, with scattered melanophores or diffuse dusky band distally, or fin unpigmented. Anal fin similar to second dorsal. Pectoral and pelvic fins

translucent to whitish, unpigmented. Caudal fin translucent, with even dusting of brown pigment, usually diffuse; some specimens with fin unpigmented.

Coloration of fresh material. A colour slide of the URM paratype from Iriomote-jima, taken shortly after death, shows that the caudal fin base and dorsal and anal fin spots are black, the pigment on the peritoneum and ventral streak along the caudal peduncle is brown; the head markings are bright red, and an internal red pigment pattern is present, consisting of a red line following the vertebral column and six short bars reaching dorsally from it. The iris is pale golden, outlined in black.

Colour images (by Seiichi Hosoya), sent to me just before going to press, are possibly of some of the paratypes in BLIH 1992269, as collection data are identical. The images show that the live fish are mostly transparent (Fig. 6) with indistinct reddish body bars, and peritoneum and vertebral column pale brown, whitish to yellowish-white dorsally. The skin covering the dorsal part of the eye is yellowish-white, crossed by two to three dark brown bars.

Distribution and ecology. This rarely-collected species is so far known from Amitori Bay, Iriomote-jima, Kabira Bay, Ishigaki-jima, Japan; Scott Reef, off Western Australia; Lizard Island, Queensland; and Taiaro Atoll, Tuamotu Islands, French Polynesia.

Its lack of pectoral and pelvic fin specialisation, the downward-opening jaws armed only with very tiny teeth, compressed body form and large eyes indicate that this species may live out over open sand or up in the water column. Unfortunately, there have been no underwater observations made on this fish while it was alive. Specimens were taken over *Halimeda* algal beds (Lizard Island), extensive *Caulerpa* beds (Scott Reef) and a *Zostera* seagrass bed (Ishigaki-jima). The Tuamotu specimens came from several lagoonal sites which included much algae, especially *Caulerpa*.

Etymology. The species name, *caudimaculata*, refers to the black spot at the base of the caudal fin.

PHYLOGENETIC ANALYSIS

Bryaninops, *Lobulogobius*, *Luposicya*, *Minysicya*, *Pleurosicya* and *Phyllogobius* were analysed, with a composite outgroup of *Acentrogobius* (*caninus* species-group), *Bathygobius* and *Glossogobius*. Characters and character state polarity (0 = primitive; 1, 2 = derived) are listed below (also Table 2), with comments on the distribution of the characters within the Gobiidae.

List of characters and polarity

1. Lower lip free at sides, fused to chin (0); lower lip fused at sides, free fold at chin (1).

Gobiines mostly do not have a free lip fold ventrally across the chin; usually the chin is smooth, although a

mental lobe or flap is present in some genera such as *Bathygobius* (Hoes 1986). It should be noted, however, that xenisthmids have the entire lower lip free (Springer 1983).

2. Ascending process of premaxillary pointed, distinct from articular process, although it may be low (0); ascending premaxillary process tip low, rounded, and fused with articular process, so that processes are indistinguishable (1).

The ascending and articular processes are usually separate or "differentiated" in gobiids, but are indistinguishable from each other in sicydiines (Harrison 1989; Parenti and Maciolek 1993). The derived condition, resembling that in sicydiines, is present in *Phyllogobius*.

3. Premaxilla without foramen (0); premaxilla with large foramen below ascending process (1).

This condition does not appear to have been observed in other gobiids, and may be an apomorphy for *Luposicya*.

4. Lower jaw teeth fixed, with no horizontally oriented teeth (0); lower jaw with one or more rows of horizontally-directed teeth on dorsal edge of dentary (1); lower jaw includes long comb-like row of teeth running along anterior face of dentary (2).

Both *Luposicya* and *Pleurosicya* have flexible horizontally-directed fine teeth, but their shape and arrangement on the dentary differs (Larson 1990). Most gobiids of the subfamily Gobiinae have fixed upright caniniform teeth. Several genera of sicydiine gobies are characterised by their fine horizontal teeth (Sakai and Nakamura 1979; Watson 1995).

5. Gill opening relatively restricted, extending from below pectoral base to under eye (0); gill opening wide, with gill membranes free from isthmus and each other (1).

Most gobiids have the gill membranes connected to the isthmus, although a few gobiine genera (such as *Lobulogobius*, *Phyllogobius* and some species of *Myrsina*) have the derived (free) condition.

6. Nape scaled (0); nape naked (1).

Predorsal scalation is rather plastic in gobiids, but generally the trend is for fewer scales or no scales in the more derived taxa. Many of the smaller coral reef forms have naked napes. The taxa generally considered to be "basal gobiids" (Gill *et al.* 1992; pers. observ.) and which were used as outgroups for the analysis (*Acentrogobius*, *Bathygobius*, *Glossogobius*), have scaled predorsals.

7. Interorbital canals united, anterior interorbital pore single (0); interorbital canals separate anteriorly, two anterior interorbital pores present; canals joined posteriorly, with medial posterior interorbital pore (1); interorbital canals completely separate, with paired anterior and posterior interorbital pores (2).

Table 2. Character states for the six commensal goby genera and the composite outgroup (*Acentrogobius-caninus* species group, *Bathygobius*, *Glossogobius*).

| Genus | Characters | | | | | | | | | | | | | | | |
|---------------------|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Composite outgroup | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| <i>Bryaninops</i> | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 |
| <i>Lobulogobius</i> | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 2 | 1 |
| <i>Luposicya</i> | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 |
| <i>Minysicya</i> | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| <i>Phyllogobius</i> | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 |
| <i>Pleurosicya</i> | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1 |

Paired interorbital canals and anterior interorbital pores are plesiomorphic for gobiids, with united interorbital canals and a single anterior interorbital pore being a synapomorphy for the subfamily Gobiinae (Takagi 1989; Pezold 1993). *Luposicya* and *Pleurosicya* possess this typical gobiine state, while all but one species of *Bryaninops* (*B. natans* lacks the canal connecting the posterior interorbital pores; state 2) and *Lobulogobius* possess state 1, and *Minysicya* and *Phyllogobius* have state 2. Pezold (1993) discussed the reversal of pore pairs for this group of gobies.

8. Pectoral rays mostly branched, no thickening of rays (0); pectoral rays all unbranched, no thickening of rays (1); pectoral rays with lower two to nine rays unbranched, tips distinctly thickened (2).

Most gobiids have branched pectoral fin rays. Unbranched pectoral rays appear in several small coral reef gobiines such as *Sueviota* (Winterbottom and Hoes 1988) and *Trimmatom* (Winterbottom and Emery 1981). Thickening of the lower rays seems to be restricted to the small coral commensals *Bryaninops*, *Luposicya*, *Phyllogobius* and *Pleurosicya*. Other gobiines with relatively fleshy fins, such as *Gobiodon*, do not have the rays thickened, at the tips or otherwise.

9. Pelvic spines without fleshy surrounding lobes (0); pelvic spines surrounded by fleshy rounded flat lobes (1).

The fleshy lobes around the pelvic spines are found only in the coral commensals *Bryaninops*, *Lobulogobius*, *Luposicya*, *Phyllogobius* and *Pleurosicya*. The specialised coral commensals *Gobiodon* and *Paragobiodon* have thick fleshy pelvic disks, but the pelvic spine is not surrounded by a lobe. Superficially similar pads are found on the tip of the pelvic spine in sicydiines (Hocse 1984; Parenti and Maciolek 1993).

The pelvic fins in *Bryaninops* can actually be used to grip narrow branches of host antipatharians and gorgonians (Fig. 7), with the fleshy pelvic-fin spines curving around the branch.

10. First gill arch free of opercle (0); first gill arch partly bound to opercle by membrane (1).



Fig. 7. *Bryaninops tigris*, gripping tip of antipatharian (black coral) branch at Mabul, Malaysia. The fleshy pelvic-fin spines are curved around the branch, and the cup-shaped fins are folded accordingly. Photograph by Rudie Kuiter.

The derived condition appears occasionally among several gobiids, with the gobiine *Heteroleotris* showing the most extreme form (first gill slit completely closed by membrane). All six of the small coral commensal genera have the lowermost part of the first gill arch variably bound by membrane to the inner face of the opercle (*Lobulogobius* with the least amount, less than one quarter bound; *Phyllogobius* has at least half of the arch bound by membrane). *Minysicya* has the lowermost quarter of the first arch (or less) bound by membrane.

11. Preopercular edge smooth, without bony processes (0); preopercular edge with bony flange or several blunt bony teeth (1).

Few gobiines have bony teeth or flanges on the posterior preopercular margin, most notably *Asterropteryx* and the *Oploponus* species-group. *Lobulogobius* has this character state.

12. Pelvic rays not flattened and thickened, branching 1–2 times (0); pelvic rays thick, flattened, branching 3–6 times (1).

Flattening of pelvic rays occurs in the subfamily Sicydiinae and in the gobiionelline *Awaous* (Parenti and Maciolek 1993), but rarely in the Gobiinae.

13. Pelvic fraenum smooth, flat, not rolled or folded forward (0); pelvic fraenum smooth or fleshy, rolled or folded forward to form anteriorly-facing pocket (1).

In the Gobiinae, this character may be restricted to *Bryaninops* and its relatives. Some specimens of *B. diannae* (Larson 1987) have a greatly reduced forward fold on the fraenum, approaching that seen in *Minysicya*.

14. Oculoscaphular canal above opercle present (0); oculoscaphular canal above opercle absent (1).

Many gobiids have an oculoscaphular canal and terminal pore over the preopercle and opercle, but this canal is reduced in some coral reef genera such as *Bryaninops* and its relatives, and several species-groups within *Eviota* (Lachner and Karnella 1980; Pezold 1993). *Bryaninops*, *Lobulogobius*, *Luposicya*, *Phyllogobius* and *Pleurosicya* all have a short oculoscaphular canal extending over the preopercle only; and in *B. nexa* the canal is broken just posterior to the eye (Larson 1987). Some specimens of *B. natans* lack this canal also. The oculoscaphular canal is always absent in *Minysicya*.

15. First haemal arch straight or obliquely-angled, not expanded laterally (0); first haemal arch expanded laterally (1); first haemal arch bent posteriorly (2).

In *Bryaninops*, *Pleurosicya*, *Phyllogobius*, *Luposicya* and *Lobulogobius*, the first haemal arch has a distinct back-curved shape. The expanded haemal arches resemble those reported by Winterbottom (1984) for *Trimma taylori* and *T. griffithsi*. This does not necessarily imply that the two groups are related. As Winterbottom states, most *Trimma* species do not have these arches expanded. The gobiionelline genus *Stigmatogobius* also has a similar form of haemal arch (Larson 2001). *Minysicya*, however, has the haemal arches of the first few caudal vertebrae expanded laterally, with the amount of expansion decreasing posteriorly, but the haemal arches are not bent posteriorly.

16. Papilla pattern with at least three longitudinal rows crossing cheek (0); papilla pattern greatly reduced, longitudinal, only one complete row crossing cheek (1).

It has been demonstrated that the least specialised gobiids have four to five rows of sensory papillae crossing the cheek (Hoese and Gill 1993), and the more derived taxa have reduced papillae rows (for example, *Eviota*, *Fusigobius*, *Priolepis* and *Trimma* (see Akihito *et al.* 1988).

Results of analyses. The PAUP* alltrees option (exhaustive search, characters unordered and unweighted), with five characters (autapomorphies) excluded, produced 25 equally parsimonious trees (CI = 0.67, RI = 0.33) of 21 steps. The trees all showed *Minysicya* placed below the other commensal taxa, but a strict consensus tree of these 25 (Fig. 8) gave no information as to relationships between the taxa, other than that *Minysicya* was less derived than the five others.

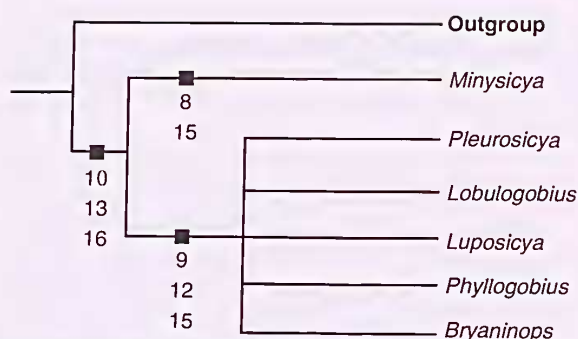


Fig. 8. Result of PAUP analysis, exhaustive search; strict consensus of 25 trees.

All six of these taxa share three synapomorphies (derived states of characters 10, 13 and 16): the first gill arch partly bound to inner face of the opercle (10), pelvic fin fraenum rolled forward to form a pocket (13) and a greatly reduced sensory papillae pattern (16). Five taxa, other than *Minysicya*, share the derived condition for characters 9 (pelvic spines with fleshy round lobes); 12 (pelvic rays broad, flattened and many-branched) and 15 (posteriorly-bent first haemal arch). *Minysicya* is supported by two characters: 8 (pectoral rays unbranched but not thickened at tips; state 1) and 15 (first haemal arch expansion; state 1).

Relationships. Given the limitations of the available data, it is not possible to resolve the relationships within this group any further, other than saying that this small group of commensal gobies is monophyletic. However, I speculate that *Minysicya* may be more closely related to *Bryaninops*, as it shares some features with some species of this genus. *Minysicya* lacks the posterior portion of the oculoscapular canal and pore over the preoperculum, and this condition is sometimes present in *B. natans*, which also lacks the canal connecting the posterior interorbital pores. *Bryaninops natans* also hovers above its associates (corals) instead of clinging to them as do most *Bryaninops* species; *Minysicya* hovers above sand, seagrass and macroalgae beds (Fig. 6). The jaw shape and teeth in *Minysicya* resemble those of *Bryaninops ridens* and *B. isis*, in that these species all have small even teeth and no canines on the side of the lower jaw. *Minysicya* has a much-reduced fold on the fraenum and the lobes on the pelvic spines are not developed (just thickened tips to spines present). The greatly reduced forward fold on the fraenum in *Minysicya* resembles that observed in a few specimens of the sponge-commensal *B. diannae* (Larson 1987).

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